Performance-Based Acceptance vs. Performance-Based Design

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Thank you to NCAT for their willingness to share slides from their BMD Workshop in my development of this presentation.

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Performance-Based Acceptance

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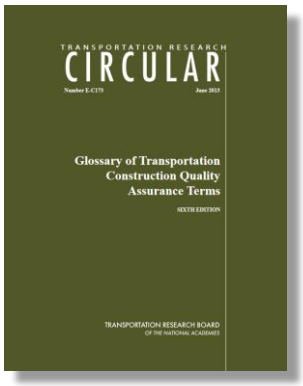
Quality Assurance (QA)



TRB Circular E-C173

"all planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service. QA includes the elements of quality control (QC), acceptance, independent assurance, dispute resolution, laboratory accreditation, and personnel certification."

MS-22 Section 10.1.3

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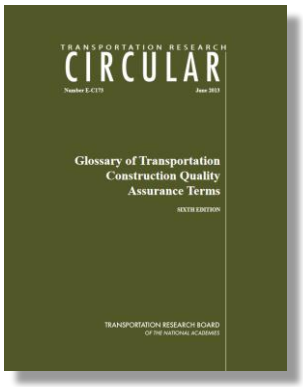
Quality Control (QC)



TRB Circular E-C173

*"the system **used by the contractor** to monitor, assess and adjust their production or placement processes to ensure that the final product will meet the specified level of quality. QC includes sampling, testing, inspection, and corrective action (where required) to maintain continuous control of a production or placement process."*

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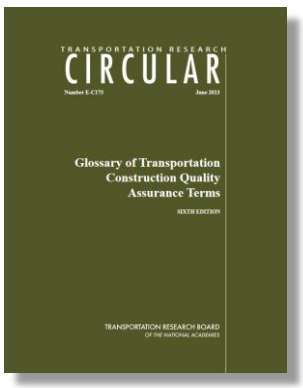
Acceptance



TRB Circular E-C173

*"the process whereby all factors **used by the agency** (i.e. sampling, testing, and inspection) are evaluated to determine the degree of compliance with contract requirements and to determine the corresponding value for a given product."*

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Performance Testing in QA

- Performance Tests (PT) should be conducted on plant produced mix and results used in acceptance decisions much like lab compacted air voids are currently used.
- Other pay factors may still include properties such as %AC, in-place density, and joint density (and smoothness for the final layer).
- Need to establish reasonable acceptance limits for PT results considering test precision. Will you use agency results for acceptance or "validated" contractor data?
- Need to establish suitable frequencies of tests.

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Performance Testing in QA

- Timeliness of QA results is critical.
- Most plants produce 200-400 tph. If results take 4 hours to complete the tests, then 800 to 1600 tons of mix have been produced during that time.
- The cost of that mix would be $50k to $150k.

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Lab Produced vs. Plant Produced Mixtures

- Changes in binder source / properties
- Changes in the aggregate properties
- Breakdown of aggregate through the plant
- Incomplete drying of aggregates
- Variations in baghouse fines return
- Differences in aging and absorption
- Inaccurate plant calibration
- Different laboratory equipment
- Different technicians
- Changes made to mix proportions

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Challenges Associated with Performance-Based Acceptance

- Testing defensibility
  - Timely results
  - Test repeatability
    - Cracking tests
    - Field vs. lab produced specimens
  - Basically, want quick and reliable
- Laboratory setup
  - Do most labs have testing capability?
  - Can the labs handle testing load?

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Performance-Based Design

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Balance the Mix Design

Strength/
Stability

Rut Resistance

Shoving

Flushing
Resistant

Smooth Quiet Ride
Skid Resistance

Durability

Crack
Resistance

Raveling

Permeability

DON'T ATTACK ONE HALF AT THE EXPENSE OF THE OTHER HALF!!

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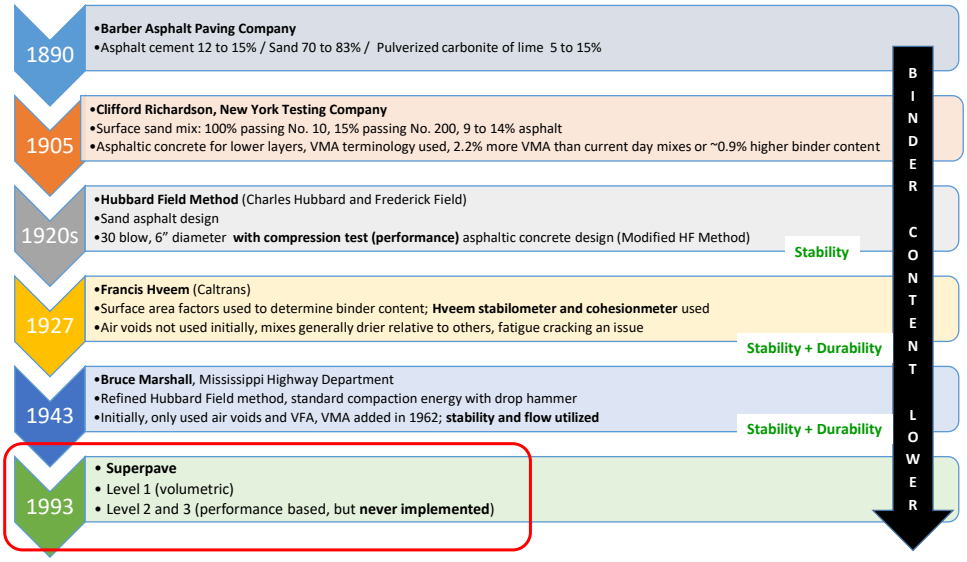
History of Mix Design



http://asphaltmagazine.com/history-of-asphalt-mix-design-in-north-america-part-2/

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What Should Have Happened with Superpave…

- Superpave called for Level 1, 2, and 3 testing based on traffic load
- Level 1 (Volumetrics + TSR) was only for up to around 1 million ESALS
- Level 2 and 3 were to be used for higher traffic loads and included rutting and cracking performance test
- Since we saw such good performance (with materials in 1993-2000), Levels 2 and 3 were soon forgotten

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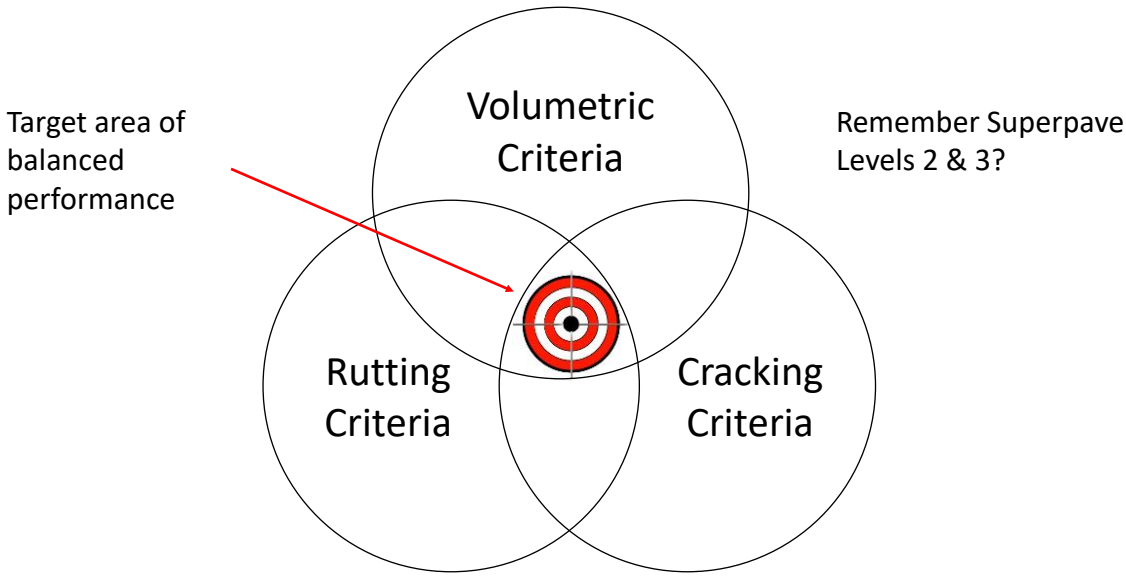
Balanced Mix Design Basic Concept



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Balance Mix Design Drivers

- Rutting?
  - NO
  - Generally not a widespread distress since Superpave implementation
- Cracking?
  - YES
  - Various cracking distresses have increased nationally
- Durability?
  - YES
  - Related to cracking, durability concerns have been noted

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Balanced Mix Design Goals

- Ensure pavement performance
  - Rutting
  - Cracking
  - Durability
- Enable innovation
  - Materials
  - Specifications
- Optimize economics

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Performance Tests

- Used to access a mixture's ability to combat or resist specific distresses.
  - Permanent deformation
  - Cracking
    - Reflective
    - Temperature-related
    - Fatigue
  - Moisture damage

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Balance Mix Design Keys

- AASHTO PP 105
  - Four approaches
  - Condition specimens
  - Test for differing distress types
  - Consider
    - Aging
    - Traffic
    - Climate
    - Layer

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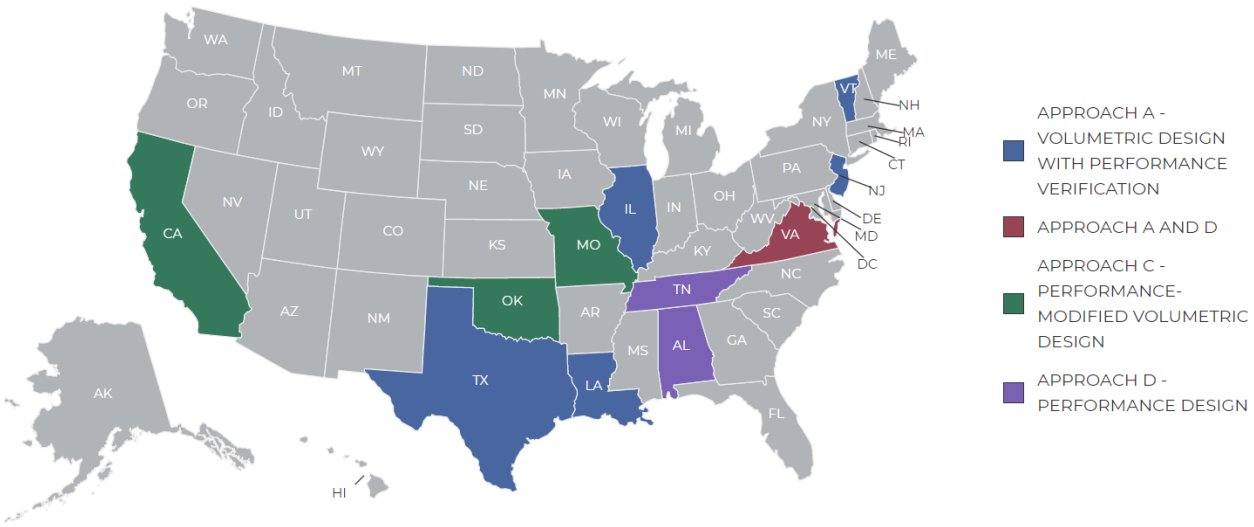
Performance Asphalt Design Approach in USA (2021)



https://www.asphaltpavement.org/expertise/engineering/resources/bmd-resource-guide/implementation-efforts

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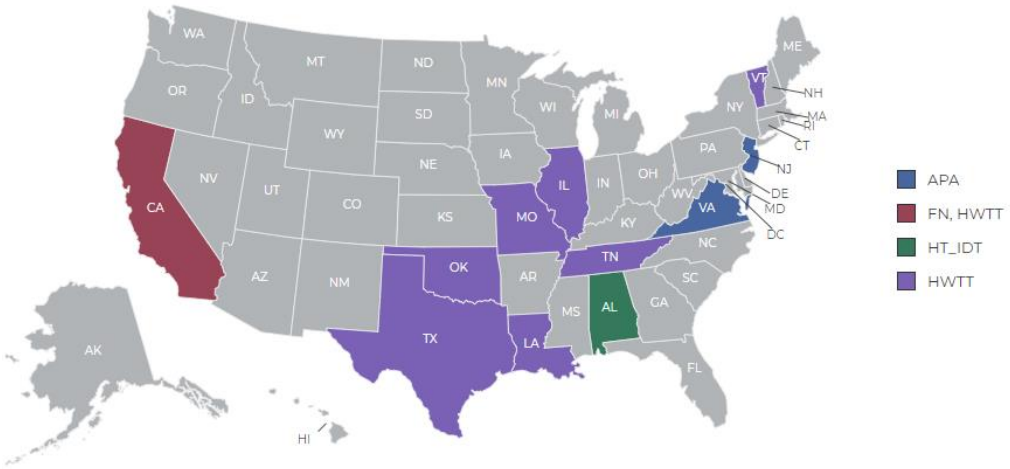
Rutting Performance Testing Options

FILTER BY: BMD APPROACH | RUTTING TEST | CRACKING TEST



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Rutting Performance Testing Options

- Hamburg Wheel Tracking Test
  - Most common choice
  - Used in eight BMD states
  - Generally gaining popularity (BMD and non-BMD states)
- Asphalt Pavement Analyzer
  - Used by two states
  - Generally loosing popularity (BMD and non-BMD states)
- Hot Indirect Tension Test
  - Used in Alabama only for BMD

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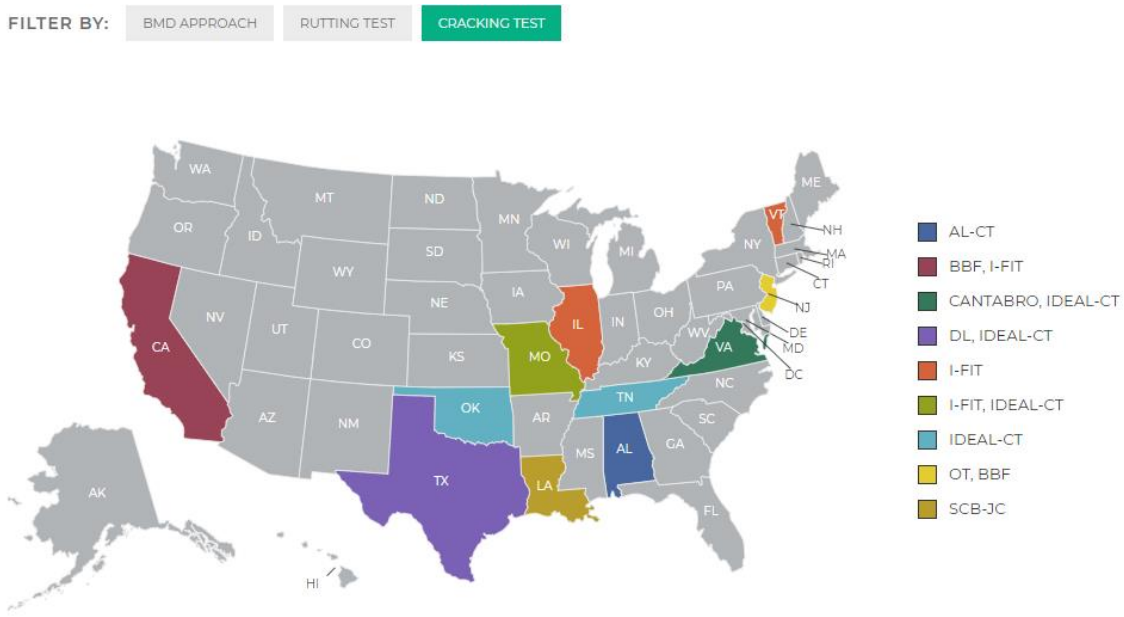
Cracking Performance Testing Options



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Cracking Performance Testing Options

- Eight test procedures currently reported
- Two tests most common
  - I-FIT test
  - IDEAL-CT
- Six states report two cracking tests are required

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Where we are going

- Interest in BMD approaches growing significantly
- Multiple combinations of design approaches and testing requirements being seen
- Likely tends that BMD will instigate (Dave's opinions)
  - Increases in binder contents
    - Mitigates cracking and durability concerns
  - Less reliance on volumetrics
  - Greater reliance on laboratory performance testing during design
  - Innovations
    - Rejuvenators
    - Alternative materials

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Thank You Asphalt Institute Membership

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Questions?

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